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LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA

60% DESIGN SUBMITTAL
Water Quality Monitoring Plan

integral

INTERNAL REVIEW DRAFT

Submitted to
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Submitted by
City of Seattle
King County

Prepared by
integral consulting inc.

7900 SE 28th Street, Suite 410
Mercer Island, WA 98040

October 2, 2006

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
COC	chemical of concern
CQAP	construction quality assurance plan
CWA	Clean Water Act
DGPS	Differential Global Positioning System
DO	dissolved oxygen
EAA	early action area
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
GIS	geographic information system
HSP	health and safety plan
LDW	Lower Duwamish Waterway
NTU	nephelometric turbidity units
PCBs	polychlorinated biphenyls
QA/QC	quality assurance and quality control
QAO	Quality Assurance Officer
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SOP	standard operating procedure
TSS	total suspended solids
WAC	Washington Administrative Code
WQMP	water quality monitoring plan
WQS	water quality standards

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1 INTRODUCTION

This water quality monitoring plan (WQMP) is a part of the 60% Design Submittal for the removal action of contaminated marine sediments and immediately adjacent bank areas at the Slip 4 Early Action Area (EAA) of the Lower Duwamish Waterway (LDW) Superfund Site located in Seattle, King County, Washington. The City of Seattle and King County are conducting the Slip 4 sediment removal action for early cleanup of contaminated sediments.

Within the Slip 4 EAA, polychlorinated biphenyls (PCBs) are the chemicals of concern (COC) in the contaminated sediments. The defined removal boundaries encompass approximately 3.6 acres. The primary objective of the removal action is to reduce the concentrations of contaminants in post-cleanup surface sediments (biologically active zone [0–10 cm]) to below the Washington State Sediment Quality Standards for PCBs and other chemicals. The sediment removal action will significantly reduce unacceptable risks to the aquatic environment resulting from potential exposure to contaminants in sediments in the slip. This cleanup will also reduce potential human health risks associated with PCBs in sediment within the LDW.

This WQMP is part of the 60% Design Submittal for implementing U.S. Environmental Protection Agency's (EPA's) selected alternative for cleanup in Slip 4 (USEPA 2006). It is a component of the overall approach to quality assurance during construction activities in the project area, including compliance with applicable or relevant and appropriate requirements (Integral 2006). The construction quality assurance plan (CQAP) outlines the overall construction project approach to quality assurance, and the role of the water quality monitoring activities in relation to other project elements.

The purposes of this WQMP are to 1) assess impacts to local surface water in Slip 4 that might result from dredging activities, dredged material translocation activities, placement of clean capping material, removal of pilings, bank soil excavation, and pier demolition; and 2) provide real-time feedback to the Contractor, the City, and EPA so that all construction activities remain in compliance with water quality criteria.

Prior to construction, EPA will issue a Clean Water Act (CWA) Section 401 Water Quality Certification that defines required water quality monitoring requirements and applicable water quality criteria as performance standards. The Contractor will be required to conduct all operations in compliance with these performance standards. In the event that any provision of the 401 Certification conflicts with this WQMP, the 401 Certification will take precedence.

1.1 OBJECTIVES

This WQMP will be used to obtain information to ensure compliance with water quality criteria during Slip 4 construction activities. The objectives of the plan are as follows:

- Monitor water quality conditions during Slip 4 construction activities including:
  - Demolition of designated structures (Crowley pier)
  - Removal of piles and debris
  - Dredging of contaminated sediments
  - Excavation of banks
  - Transportation and offsite disposal of dredged and excavated materials
  - Placement of a sediment cap on the bed and side slopes of the slip in designated areas
  - Placement of outfall scour protection.
- Verify that water quality conditions are within the prescribed limits of the EPA 401 Water Quality Certification.
- Help determine when to take appropriate action to modify construction activities to ensure protection of the environment if and when exceedances of water quality criteria occur.
- Promptly determine if modifications were effective.
- Define the lines of communication and response procedures in the event of exceedances of water quality criteria.

This WQMP defines field procedures for conducting the water quality monitoring, laboratory analytical methods, and quality assurance procedures; and summarizes the requirements for the timing of monitoring activities relative to specific construction elements.

1.2 REPORT ORGANIZATION

The remaining sections of this document describe the field monitoring program and sampling procedures to be used during the activities described above, and constitute the Sampling and Analysis Plan (SAP) for the water quality monitoring efforts. Section 2 provides the data collection activities that will take place during this monitoring program. Section 3 describes the field sampling methods and quality assurance/quality control (QA/QC) samples. Laboratory sample handling and processing are described in Section 4. Finally, references are provided in Section 5.

Supporting information is provided in the following appendices:

- **Appendix A.** Slip 4 Surface Water Quality Monitoring Quality Assurance Project Plan
- **Appendix B.** Slip 4 Surface Water Quality Monitoring Health and Safety Plan
- **Appendix C.** Standard Operating Procedure for YSI 6600 Multi Probe
- **Appendix D.** Standard Operating Procedure for Niskin Bottle
- **Appendix E.** Water Quality Parameters Field Log Forms.

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* THINK IN OUR INTEREST TO ADD sed samples at stations off project to protect against charges w/ affected levels on Boeing + Crowley

2 DATA GENERATION AND ACQUISITION

The water quality monitoring will take place during the removal action activities to monitor surface water quality within Slip 4 and ensure that all construction activities are conducted in compliance with EPA's 401 Water Quality Certification.

2.1 SAMPLING DESIGN AND RATIONALE

In-water construction activities include demolition of structures, dredging, excavation of banks, material dewatering, material transloading from barge to truck, and placement of clean capping material. The material to be removed and then disposed of at an approved upland landfill facility includes contaminated sediment that will be dewatered, wood debris and old wood pilings, cement pilings, bank soil, and other debris. Monitoring activities will depend upon the removal action activity being conducted and the type of material being dredged or excavated.

Certain construction activities will occur "in-the-dry," that is, without any disturbance of submerged sediments or the water column. These activities may include demolition, bank excavation, or other construction elements. Activities that occur in-the-dry are not subject to water quality monitoring.

+ thought EPA set the distance

Given the confined space and restricted water flow within Slip 4, two pre-established monitoring/sampling stations will be employed. A compliance sampling station will be located mid-slip at 100 meters from the work site boundary line, and an ambient sampling station will be located at the entrance of the slip just off the LDW main channel (Figure 2-1). *In situ* water quality measurements and collection of water samples for chemical analyses will be compared to state water quality standards for compliance, as defined in the 401 Certification.

In situ water quality measurements will include turbidity, dissolved oxygen (DO), temperature, and salinity. In general, real-time turbidity measurements will be used to help determine when modifications to construction activities should be made, and whether grab samples should be collected for COC analysis

Water grab samples that will be collected will be submitted for analysis of COCs (total suspended solids [TSS] and PCB Aroclor concentrations). All TSS and PCB analyses will be performed on a rush basis (24–48 hours) in order to provide additional information about possible water quality exceedances in a rapid time frame and allow for appropriate modifications to the construction activities.

Section 4.4 presents the water quality reporting and feedback mechanisms for responding to any exceedances of water quality criteria.

2.1.1 Monitoring and Sampling Depths

In situ water quality measurements will be taken at two depths: near-surface (approximately 3 ft below the water surface) and near-bottom (approximately 3 ft above the mudline). Where grab samples are to be collected, the sample will be obtained from the water depth exhibiting the greatest turbidity.

2.1.2 Sampling Scheme for Water Quality Monitoring

Table 2-1 shows the sampling scheme for the water quality monitoring at Slip 4. *In situ* water quality measurements and grab samples will be collected at two pre-designated stations and potentially at discretionary stations, during three project phases: bank excavation, sediment dredging, and capping. If demolition activities cause observable turbidity, sampling will also occur during this phase. The sampling frequency and sampling types are described in detail for each type of construction activity in the following subsections.

Note: For each of the cases described below, if water quality turbidity exceedances are encountered, the reporting and response mechanisms described in Section 4.4 will be followed. Additional discretionary locations may be monitored to assess whether the source of the turbidity exceedance is from Contractor operations or other sources (e.g., stormwater). In addition, EPA may direct modification of any of the activities described below.

2.1.2.1 Bank Excavation (in-water work only)

An intensive monitoring program will occur during the first five days of active excavation. *In situ* water quality measurements will be collected twice daily (at slack tide and ebb tide) at both the ambient and compliance stations (Table 2-1). If water turbidity exceedances occur at the compliance station, one water grab sample will be collected at the compliance station, at depth with maximum turbidity.

After the first week of excavation, a moderate monitoring program will take place (Table 2-1). *In situ* water quality measurements will be taken at two non-consecutive days per week, and measurements will be taken twice daily (at slack tide and ebb tide) at the ambient and compliance stations. No water grabs are expected to be sampled.

2.1.2.2 Sediment Dredging

An intensive monitoring program will occur during the first five days of active dredging. *In situ* water quality measurements will be collected twice daily (at slack tide and ebb tide) at both ambient and compliance stations (Table 2-1). On the second day after initiation of dredging, one grab sample will be collected at the compliance station, at depth with maximum turbidity. Upon any water turbidity exceedances at the compliance station, one water grab sample will be collected at the compliance station, at depth with maximum turbidity.

After the first week of dredging a moderate monitoring program will take place (Table 2-1). *In situ* water quality measurements will be collected on two non-consecutive days per week, and measurements will be taken twice daily (at slack tide and ebb tide) at the ambient and compliance stations. If any water turbidity exceedances occur at the compliance station, EPA will be consulted as to the need for water grab sample collection.

2.1.2.3 Capping

A moderate monitoring program will take place during the first week of capping (Table 2-1). *In situ* water quality measurements will be collected on two non-consecutive days during the first week, and measurements will be taken twice daily (at slack tide and ebb tide) at the ambient and compliance stations. No water grabs are expected to be sampled during capping. After the first week, *in situ* water quality measurements will be collected once per week, at slack and ebb tide, at the ambient and compliance stations.

2.1.2.4 Demolition (in-water work only)

If demolition activities may cause observable turbidity, *in situ* water quality measurements will be collected at the ambient station and compliance station. Upon any water turbidity exceedances at the compliance station, EPA will be consulted regarding the potential need for grab sampling.

2.2 APPLICABLE AND RELEVANT WATER QUALITY STANDARDS

During construction, Washington state water quality standards will need to be attained at a specified point of compliance. These criteria include general water use and criteria classes (WAC 173-201A-030) for turbidity, DO, and toxic conditions, and the numeric toxic substances criteria (WAC 173-201A-040).

Point of Compliance

EPA's water quality certification will specify an authorized mixing zone during in-water construction activities, and the point of compliance for meeting the water quality standards will be set at the boundary of this mixing zone. Because of the confined geometry of Slip 4, and the likelihood at any given time of multiple construction activities at various locations within the removal boundaries, a moving point of compliance would likely be unworkable. Therefore, the entire removal area will be considered a zone of activity, and point of compliance measurements will occur at a fixed location 100 m (328 ft) directly upslip (southwest) of the construction boundaries. Additional monitoring points include ambient stations and discretionary stations, as shown on Figure 2-1.

Specific Criteria

Water quality standards (WQS) pertaining to the marine waters of Elliott Bay (Class A) (WAC 173-201A-140 Specific Classifications—Marine Waters) and the fresh waters of the Duwamish River (Class B) (WAC 173-201A-130 Specific Classifications—Freshwater) potentially could apply to this project. The lower reach of the Duwamish Waterway is a saltwater wedge estuary with a lower layer of nearly undiluted seawater moving upstream from Puget Sound and a surface layer of riverine fresh water mixed with saltwater. The saltwater wedge is present in the vicinity of Slip 4 throughout the year, and, in the vicinity of Slip 4, the waterway generally remains stratified with a distinct freshwater/low salinity surface layer overlying a saltwater bottom layer.

Circulation in the Duwamish Waterway is controlled by freshwater inflow and tidal action. In general, on a rising tide, water in both the bottom saltwater wedge and surface layer flows upstream. On a falling tide, the flow is downstream. Although water moves upstream and downstream with the tides, circulation in the vicinity of Slip 4 consists of a net downstream flow in the surface layer and a net upstream flow in the salt wedge layer (King County 1999).

Based on previous water quality certifications on the Duwamish River, it is expected that Class B marine water quality standards will apply to this project except within the authorized mixing zone, unless there is a practical reason why results should be compared to a different standard (e.g., results from the upper water column indicate that turbidity is an issue in the freshwater lens due to project activities—a freshwater standard could potentially be applied at EPA's discretion). The following are specific water quality standards for Slip 4:[1]

Dissolved Oxygen. At the point of compliance (edge of the mixing zone), DO shall exceed 5.0 mg/L. When natural conditions such as upwelling occur, causing the DO to be depressed near or below 5.0 mg/L, natural DO levels may be degraded by up to 0.2 mg/L by human-caused activities. If for any reason DO should drop below 3.5 mg/L, in-water work should cease immediately.

[1] EPA's CWA 401 Water Quality Certification will set the final standards.

Turbidity. At the point of compliance (edge of the mixing zone), turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

Chemicals of Concern. At the point of compliance (edge of the mixing zone), chemical concentrations shall not exceed the numeric toxic substances acute criteria for marine water (WAC 173-201A-040).

Class B marine water quality standards are shown in Table 2-2. For chemical analysis of water grab samples, Washington State WQS acute toxic criteria (Table 2-3), as defined in EPA's 401 Water Quality Certification, will be applied as the benchmark for compliance for total PCB concentrations.

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3 FIELD SAMPLING PLAN

The following sections describe the project organization, anticipated field event schedule, field monitoring and sampling methods, and the laboratory analyses to be conducted.

3.1 PROJECT ORGANIZATION

This section presents the organizational structure for sampling and analysis activities associated with the Slip 4 water quality monitoring program, including team organization and responsibilities, fieldwork, data management, and laboratory analyses. Section 4.4 describes the lines of reporting and response mechanisms that will be used to respond to any exceedances of water quality criteria.

3.1.1 Team Organization and Responsibilities

The organization and responsibilities of the investigation team are summarized below:

Ms. Karen Keeley, U.S. EPA Region 10, is EPA's Remedial Project Manager for Slip 4. Ms. Keeley is responsible for approving this WQMP and any subsequent modifications, and for making final agency decisions based on the results of the water quality monitoring.

Ms. Erika Hoffman, U.S. EPA Region 10, represents EPA's Aquatic Resources Unit and will provide technical determinations of the water quality monitoring results.

Ms. Ginna Grepo-Grove, U.S. EPA Region 10, is EPA's Quality Assurance Manager for this project. Ms. Grepo-Grove will review and provide final approval of the WQMP Quality Assurance Project Plan (QAPP) and data quality report.

Ms. Jennie Goldberg is the project coordinator and the City of Seattle's project manager, responsible for providing contract direction to Integral.

The City's resident engineer is responsible for directing the Contractor to modify operations or stop work, as needed.

The construction contractor is responsible for conducting all activities in compliance with EPA's 401 Certification, as determined by the results of this water quality monitoring program.

Integral is responsible for implementing the WQMP, reporting exceedances to the Contractor, EPA, and the City's Resident Engineer, and preparing the associated reports for EPA on behalf of the City of Seattle and King County.

3.1.2 Integral Personnel

Integral project personnel for the WQMP are identified below.

Position	Personnel
Integral Principal in Charge	Betsy Day
Construction Oversight Manager/Quality Assurance Officer	David Schuchardt
Field Supervisor/Safety Officer	Jane Sund or Ian Stupakoff
Project QA Coordinator	Reid Carscadden
Laboratory Coordinator and QA Manager	Abbie Spielman
Data Manager	Tom Schulz

The organizational structure of the lead sampling and analysis personnel and analytical laboratory is shown in Figure A4-1 of the WQMP QAPP (Appendix A).

3.2 FIELD SAMPLING SCHEDULE

Field work for the removal action is limited by the chinook salmon migration window and is tentatively scheduled to begin in early October 2007 and estimated to be completed in approximately 10–120 days. Many of the field tasks depend on tide levels and will be scheduled accordingly.

3.3 FIELD MONITORING AND SAMPLING METHODS

This WQMP includes measurements of water quality parameters with a YSI 6600 multi probe and collection of water samples with a Niskin bottle. The methods to be used for the collection of these field data are described in this section. The results of daily standard measurements of water quality parameters such as turbidity and TSS will be synoptic with the results of water chemistry collected with a Niskin bottle. The water chemistry analytical results will be delayed by a day or two from the instantaneous surface water quality parameters measurements because of required laboratory turnaround times for chemical analyses. For this reason, turbidity will be the primary indicator of potential water quality problems during monitoring.

All field documentation, station positioning, sample handling, equipment decontamination, waste disposal, chain-of-custody, and QC procedures will are described below. All field documentation will be recorded on either water quality parameters log forms or field notebooks (Appendix E).

All field activities will be conducted in accordance with the site-specific health and safety plan (HSP) that is provided in Appendix B.

3.3.1 Sampling Vessels

A sampling vessel will be used that is equipped with a deck large enough to accommodate one to two crewmembers in addition to the captain. One of the crew members will also be a navigator. The vessel will have enough deck space to accommodate a YSI multi probe, a Niskin bottle, two coolers, and sampling equipment boxes containing sample jars, and other ancillary equipment. The vessel will include a capstan (minimum of 350-lb capacity davit [pulling winch]), navigational lights, anchors, and basic sonar.

3.3.2 Station Positioning

Latitude and longitude coordinates will be obtained during surface water sampling operations using a Differential Global Positioning System (DGPS). The standard projection method to be used during field activities is Horizontal Datum: North American Datum of 1983 (NAD83), State Plane Coordinate System, Washington North Zone. The positioning objective is to accurately determine and record the positions of all sampling locations to within ±2 m.

Station positioning from the sampling vessel will be accomplished using a DGPS, which consists of a GPS antenna and trimble pro XRS receiver and handheld TSC1 data logger. Positioning accuracies on the order of ±1–3 m can be achieved by avoiding the few minutes per day when the satellites are not providing the same level of signal. The GPS system provides the operator with a listing of the time intervals during the day when accuracies are decreased. Avoidance of these time intervals permits the operator to maintain better positioning accuracy. The GPS receiver routes latitude and longitude to an integrated navigation system (in the handheld TSC1), which displays the boat's position in plan view. Navigation data, such as range and bearing from the target sampling location, are provided at a user-defined scale to help the vessel pilot navigate to the desired location.

3.3.3 Field Equipment and Supplies

Field equipment and supplies include sampling equipment, utensils, decontamination supplies, sample containers, coolers, logbooks and forms, personal protection equipment, and personal gear. Protective wear (e.g., hard hats, gloves) that are required to ensure the health and safety of field personnel are specified in the HSP (Appendix B).

Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory. Commercially available, pre-cleaned sample bottles will be used, and the laboratory will maintain a record of certification from the suppliers. The bottle shipment documentation will record batch numbers for the bottles. With this documentation, bottles can be traced to the supplier, and bottle wash analysis results can be reviewed. The bottle wash certificate documentation will be archived in the Integral project file. Field personnel will not obstruct these stickers with sample labels.

Sample containers will be clearly labeled at the time of sampling. Labels will include the project name, sample location and number, sampler's initials, analysis to be performed, date, and time.

3.3.4 Equipment Decontamination

The Niskin bottles will be rinsed with site water and washed with Liquinox™ detergent prior to use and between sampling stations using the following process:

- Rinse with site water
- Wash with Liquinox™
- Rinse with methanol
- Final rinse with distilled water at the field lab or site water when in the field.

Niskin bottles will be kept wrapped in plastic bags until time for use. To minimize sample cross-contamination, disposable gloves will be replaced between stations.

3.3.5 Collection of Surface Water Samples

Water samples will be collected using a Niskin bottle, using the standard operating procedure (SOP) provided in Appendix D. The bottle is attached to a cable and lowered by means of a winch to the desired depth of sampling. The Niskin bottle is a plastic cylinder with stoppers at each end, connected by an elastic cord. The stoppers are held open by plastic cords attached to a release mechanism. Clamps on the side of the cylinder are used to attach the bottle to a hydrographic line (a 3/16-in. steel cable with a 60-lb weight at the end) so that it can be lowered to a discrete depth in the water. When a small weight encircling the hydrographic line, called a "messenger," is released down the line, it strikes the release mechanism resulting in the two stoppers being pulled into the ends of the cylinder, thereby trapping water from that depth. The Niskin bottles will be retrieved and the water sample transferred to the pre-cleaned sample bottles. Table 3-1 provides the storage temperatures, preservation, and holding times for surface water samples.

3.4 CHAIN-OF-CUSTODY PROCEDURES

Because samples collected in support of CERCLA activities may be used in litigation, their possession must be traceable from the time of sample collection through laboratory and data analysis to introduction as evidence. To ensure that samples are traceable, chain-of-custody procedures will be used.

Samples will be in custody if they are in the custodian's view, stored in a secure place with restricted access, or placed in a container secured with custody seals. A chain-of-custody record will be signed by each person who has custody of the samples and will accompany the samples at all times. Copies of the chain-of-custody will be included in laboratory and QA/QC reports.

At minimum, the form will include the following information:

- Site name
- Field coordinator's name and team members responsible for collection of the listed samples
- Collection date and time of each sample
- Sampling type (e.g., composite or grab)
- Sampling station location
- Number of sample containers shipped
- Requested analysis
- Sample preservation information
- Name of the carrier relinquishing the samples to the transporter, noting date and time of transfer and the designated sample custodian at the receiving facility.

The field coordinator, as the designated field sample custodian, will be responsible for all sample tracking and chain-of-custody procedures for samples in the field. The sample custodian will be responsible for final sample inventory and will maintain sample custody documentation. The custodian will complete chain-of-custody forms prior to removing samples from the sampling vessel. Upon transferring samples to the laboratory sample custodian, the field coordinator will sign, date, and note the time of transfer on the chain-of-custody form.

The original chain-of-custody form will be transported with the samples to the laboratory. Each laboratory will also designate a sample custodian who will be responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed upon transfer of the samples.

3.5 SAMPLE HANDLING AND TRANSPORT

Sample coolers and packing materials will be supplied by the analytical laboratories. Individual sample containers will be placed into a sealed plastic bag. Samples will then be packed in a cooler lined with a large plastic bag. Glass jars will be packed to prevent breakage and separated in the shipping container by bubble wrap or other shock-absorbent material. Ice in sealed plastic bags or "blue ice" will then be placed in the cooler to maintain a temperature of approximately 4° C. When the ice chest is full, the chain-of-custody form will be placed into a zip-locked bag and taped on the inside lid of the cooler. If shipment is to be performed by a third-party (i.e., FedEx), a temperature blank will be added to each cooler.

Each ice chest will be sealed with three chain-of-custody seals. On each side of the cooler a *This End Up* arrow label will be attached; a *Fragile* label will be attached to the top of the cooler. The coolers will be clearly labeled with sufficient information (i.e., name of project, time and date container was sealed, person sealing the cooler, and company name and address) to enable positive identification.

These packaging and shipping procedures are in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24. Coolers containing sediment for chemical analyses may be transported to the laboratory by courier or overnight shipping service, or will be hand-delivered by Integral personnel to the analytical laboratory.

Upon receipt of the samples by the laboratory, the laboratory sample custodian will inventory the samples by comparing sample labels to those on the chain-of-custody document. The custodian will enter the sample number into a laboratory tracking system by project code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples in an appropriate secure area.

3.6 FIELD LOGBOOK AND FORMS

All field activities and observations will be noted in a field logbook during fieldwork. The field logbook will be a bound document containing individual field and sample log forms. Information will include personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, deviations from the WQMP) and the reasons for these changes will be documented in the field logbook. The logbook will identify onsite visitors (if any) and the number of photographs taken at the sampling location (if any). The field coordinator is responsible for ensuring that the field logbook and all field data forms are correct.

The descriptions of all field activities will be clearly written with enough detail so that participants can reconstruct events later if necessary. Field logbooks will describe any changes that occur at the site, in particular, personnel and responsibilities, or deviations from the WQMP, as well as the reasons for the changes. Requirements for logbook entries will include the following:

- Logbooks will be bound, with consecutively numbered pages.
- Removal of any pages, even if illegible, will be prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour clock (e.g., 0900 a.m. for 9 a.m. and 2100 for 9 p.m.), will appear on each page.
- When field activity is complete, the logbook will be entered into the project file.

In addition to the preceding requirements, the person recording the information must initial and date each page of the field logbook. If more than one individual makes entries on the same page, each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry. The field team and task leader, after reading the day's entries, also must sign and date the last page of each daily entry in the field logbook.

Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

The type of information that may be included in the field logbook and/or field data forms includes the following:

- Names of all field staff
- Sampling vessel
- A record of site health and safety meetings, updates, and related monitoring
- Station name and location
- Date and collection time of each sample
- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort

- Sample description
- Depth of mudline below water surface
- Any deviation from the WQMP.

Field data sheets and sample description forms will be completed for all samples and kept in the project file. Examples of the types of forms that may be used are provided in Appendix E.

3.7 INVESTIGATION-DERIVED WASTE

Investigation-derived waste consists mainly of multi probe standard solutions used during calibration procedures and will disposed of in the sanitary system followed by copious amounts of water.

3.8 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

All field personnel will be 40-hour certified for hazardous waste operations and current on 8-hour refresher courses to comply with the 29 CFR 1910.120 (e)(3) regulation for working at Superfund sites.

3.9 FIELD QUALITY CONTROL SAMPLES

QC requirements will be instituted during field sampling, laboratory analysis, and data management to ensure that the data quality objectives are met (Appendix A, QAPP). Detailed information on QA/QC procedures, limits, and reporting is described in the QAPP (Appendix A).

The types of field QC samples that will be collected are listed in Table A6-1 of the QAPP (Appendix A). Field QC samples will include field replicate samples and equipment rinsate blank samples. These field QC samples will be generated at a frequency of one set per week, as shown in Table A6-1 of the QAPP.

3.10 LABORATORY ANALYSES

Laboratory analyses will be performed according to the Slip 4 Water Quality Monitoring QAPP (Appendix A). Samples will be analyzed for PCB Aroclors and TSS, as detailed in Table A6-2 of the QAPP.

4 DATA MANAGEMENT AND REPORTING

During field, laboratory, and data evaluation operations, effective data management is the key to providing consistent, accurate, and defensible data and data products. The management and reporting of field and laboratory data will generally follow the procedures outlined by Integral (2004). Changes or additions to those procedures based on the specific requirements of this WQMP are discussed in the following sections.

4.1 SAMPLE NUMBERING

According to Integral (2004), all samples will be assigned a unique identification code based on a sample designation scheme designed to suit the needs of the field personnel, data management, and data users. Sample identifiers will consist of two components separated by dashes. The first component is SL4 to identify the data as originating in Slip 4, and the second component, SW, indicates that it is a surface water sample. Samples will be collected from two sampling locations (also called the station name): a compliance sampling station (01), and an ambient sampling station (02). Samples will be collected during slack and ebb tides at both stations during three project phases: bank excavation, sediment dredging, and capping. If demolition activities cause observable turbidity, sampling will also occur during this phase. Samples collected at slack and ebb tides will include the letters "A" and "B," respectively, after the station number.

Some examples of sample labels include:

- **SL4-SW01A:** Slip 4 surface water sample collected from Station 1 (compliance station) at slack tide.
- **SL4-SW02B:** Slip 4 surface water sample collected from Station 2 (ambient station) at ebb tide.
- **SL4-SW01B-2:** Slip 4 replicate surface water sample collected from Station 1 at ebb tide.

4.2 DATA MANAGEMENT

Integral will use the Environmental Quality Information System (EQuIS) in conjunction with the Arc View 8.1 geographic information system (GIS) tools to manage, summarize, and report the generated data. From within the EQuIS-Arc View GIS interface, data stored in the warehouse (data and reference tables) may be integrated to allow the production of shape files with relevant site features such as property names, land use, bathymetry, or outfalls. This greatly reduces the number of files to manage and allows the primary database manager to focus on refreshing the central database. The system also allows for the project data to refresh each time the Arc View interface is invoked. Accessing an updated common repository ensures that users are working with the same data as well as using same conventions.

The system's data dictionary contains conversion formulas so that any of the previously mentioned coordinate types can be recalculated to facilitate the use of location objects in ARC View GIS interfaces. To ensure proper documentation and consistency in chemical nomenclature, methodologies, and the standardization of analytical reporting of results, the system contains reference tables that store federal and state guidelines and terminology adopted for EPA remedial investigative projects. These reference tables are used to verify that chemical facts being projected into the graphic system are authentic. They are also used to ensure that queries of specific data facts out of the system are done using reputable sources.

4.3 DATA REVIEW AND REPORTING SCHEDULE

Due to the rush nature of all analyses and the need to make immediate real-time decisions about construction activities based on any water quality exceedances, the laboratory results will not undergo data validation by an independent validator prior to reporting of results. The laboratory will, however, provide a data package for each sample delivery group or analysis batch that is comparable in content to a full Contract Laboratory Program package. It will contain all information required for a complete QA review, including all the associated raw data so formal validation could be performed if subsequently required. Further discussion of the data review, reporting, and verification of the laboratory results is included in Sections B, C, and D of the QAPP (Appendix A).

A water quality monitoring report will be prepared by Integral and submitted to EPA within 60 days after completion of construction, as part of the Removal Action Completion Report. The water quality monitoring report will include a description of the field sampling effort (e.g., procedures, sample and station locations and depths, field sample observations); descriptions and rationale for any deviations from the WQMP and QAPP; a detailed discussion of any data quality issues; and tabulated field and laboratory data. Electronic data will be provided to EPA once all analyses have been completed.

Information to be included in the water quality monitoring report will include but is not limited to:

- Field methods and any deviations from the WQMP
- Field change requests
- Actual sample locations
- Tabulated water quality measurement results

- Laboratory analysis results
- Sample description forms
- Photo documentation.

4.4 WATER QUALITY FEEDBACK AND RESPONSE MECHANISMS

The primary concern that occurs during water quality monitoring is detection of excess turbidity from the construction activities. Freshwater inflows from storm drains also enter Slip 4 and may introduce turbidity not associated with construction. Specific monitoring elements may be included if turbidity exceedances are observed at the point of compliance and are suspected of being a turbid freshwater lens not associated with construction.

Based on the monitoring results, if DO, turbidity, or a COC acute standard is exceeded at the point of compliance (boundary of the mixing zone), the following steps will be taken:

- The field supervisor will immediately notify the quality assurance officer (QAO) of the condition, and proceed to verify the result within 20 minutes. Additional discretionary locations may be monitored to assess whether the source of the turbidity exceedance is from contractor operations or other sources (e.g., stormwater).
- If the exceedance is confirmed, the QAO will immediately notify the contractor's site supervisor, the resident engineer, and EPA.
- The contractor will modify its operations.
- The field supervisor will conduct additional monitoring to assess the results.
- The QAO will report the results to the contractor's site supervisor, the resident engineer, and EPA. If exceedances persist, EPA may direct corrective actions such as increased monitoring frequency, monitoring for COCs, specific construction modifications, or EPA may direct construction to cease.

The reporting and feedback loops for this communication are depicted in Figure 4-1.

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5 REFERENCES

Integral. 2004. Lower Duwamish Waterway Slip 4 early action area: Sampling and analysis plan for boundary definition. Prepared for City of Seattle and King County, WA. Integral Consulting Inc., Mercer Island, WA.

Integral. 2006. Lower Duwamish Waterway Slip 4 early action area: Engineering evaluation/cost analysis. Prepared for City of Seattle and King County, WA. Integral Consulting Inc., Mercer Island, WA.

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USEPA. 2006. Action memorandum for non-time critical removal action at the Slip 4 early action area of the Lower Duwamish Waterway Superfund Site, Seattle, Washington, dated May 3, 2006. U.S. Environmental Protection Agency, Region, 10, Seattle, WA.

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